Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Improved Exciton Photoluminescence of Zn-doped Quasi-2D Perovskite Nanocrystals and Its Application as Luminescent Material in Light-emitting Devices

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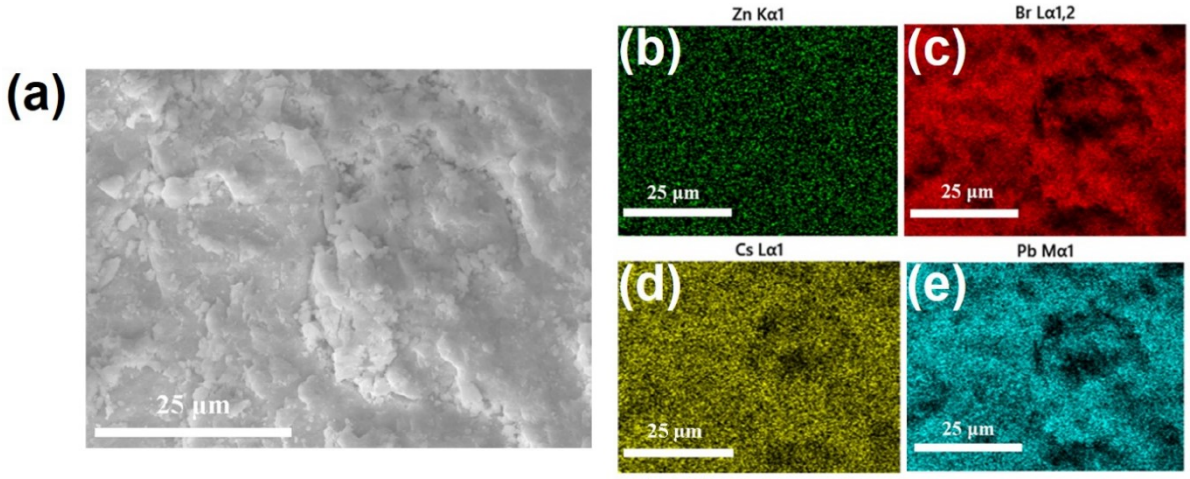

Figure S1. (a) SEM image of 20%Zn-$PEA_2CsPb_2Br_7$ NCs powders and corresponding (b-e) elemental mapping images of Zn, Br, Cs, and Pb elements.

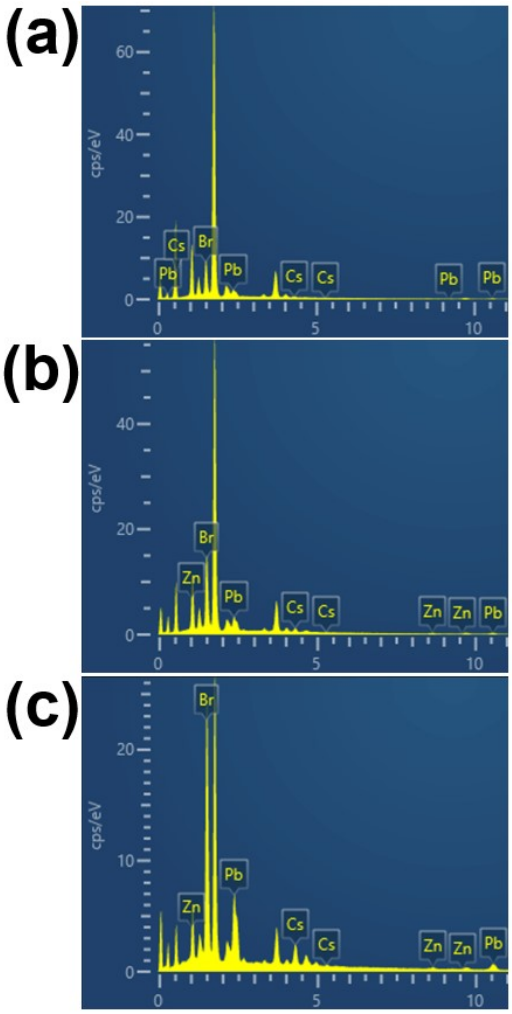

Figure S2. Energy dispersive spectroscopy (EDS) of (a) $PEA_2CsPb_2Br_7$ NCs, and 20%Zn-$PEA_2CsPb_2Br_7$ NCs (b) before and (c) after repeated cleaning with antisolvent ethyl acetate.

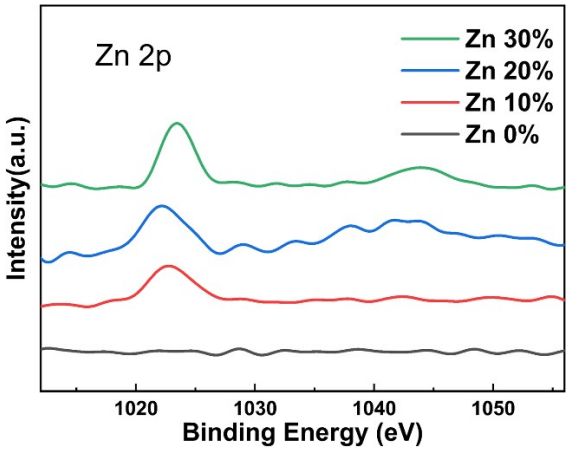

Figure S3. High resolution XPS spectra of Zn 2p with different proportions of Zn.

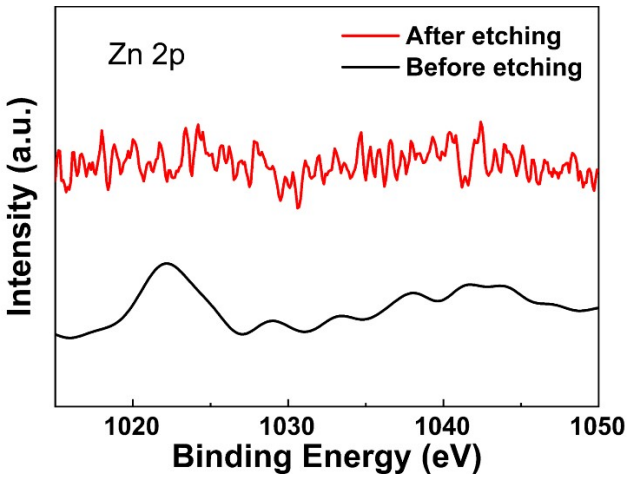

Figure S4. High resolution XPS spectra of 20%Zn-$PEA_2CsPb_2Br_7$ NCs with and without Ar ions etching.

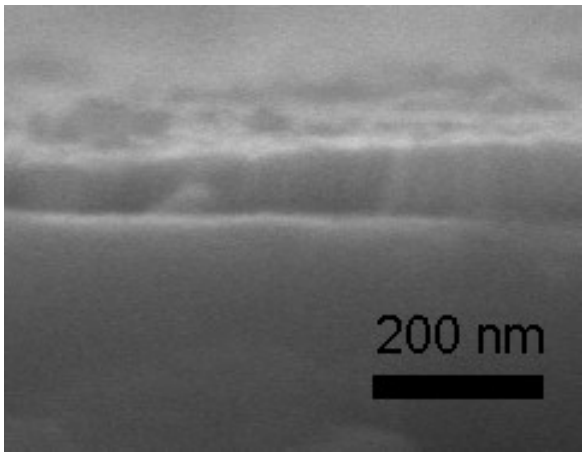

Figure S5. The cross-section SEM image of Al film constructed on quartz substrate.

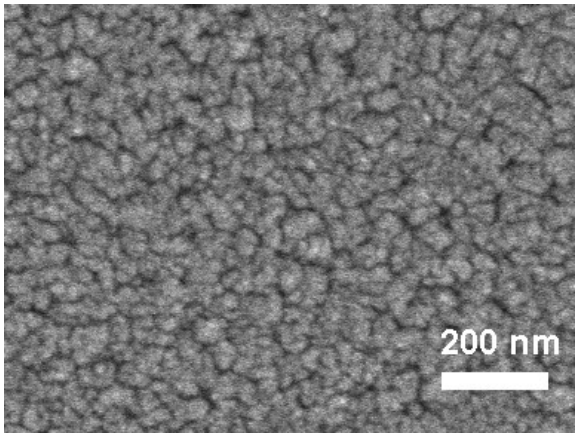

Figure S6. The SEM image of bare Al film morphology.

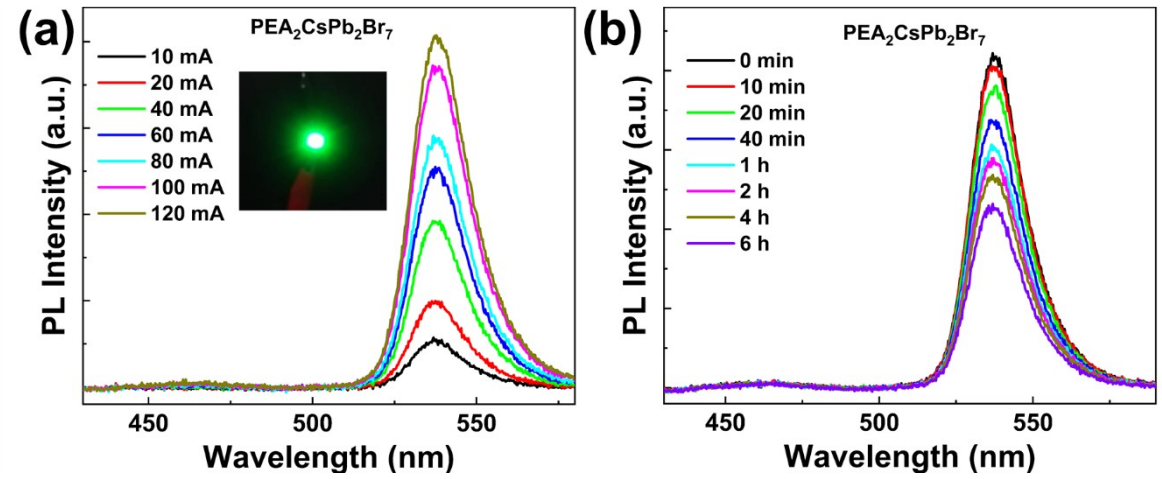

Figure S7. (a) PL spectra of green LED fabricated by $PEA_2CsPb_2Br_7$ NCs at different injected currents of 10-120 mA. (b) Time-dependent PL spectra of green LED fabricated by $PEA_2CsPb_2Br_7$ NCs at operating current of 30 mA.

Table S1. EDS analysis of $PEA_2CsPb_2Br_7$ NCs, and 20%Zn-$PEA_2CsPb_2Br_7$ NCs before and after repeated cleaning with antisolvent CB.

Sample	Atomic ratio %				Zn/(Zn+Pb) ratios %
	Cs	Pb	Br	Zn	
Pristine NCs	12.1	23.1	64.8	0	0
Unwashed 20%Zn-NCs	8.1	25.6	64.1	2.2	7.9
Washed 20%Zn-NCs	12.0	32.5	54.4	1.1	3.3

Table S2. Atomic ratio of perovskite NCs with different ratios of Zn^{2+} (0%, 10%, 20%, 30%) using XPS analysis.

Zn/Pb mole feeding ratios	Atomic ratio %				Zn/(Zn+Pb) mole ratios %
	Cs	Pb	Br	Zn	
0	13.77	15.14	71.09		0.00
0.1	13.21	15.2	71.04	0.55	3.49
0.2	14.43	14.34	70.08	1.15	7.42
0.3	14.49	15.07	68.46	1.99	11.66

Calculation of fluorescence decay parameters

The PL decay curves of 20% Zn-doped and pristine perovskite NCs can be fitted by the following triple-exponential decay function

$$I(t) = A_1 \exp(-t/\tau_1) + A_2 \exp(-t/\tau_2) + A_3 \exp(-t/\tau_3) \quad (1)$$

where A_1, A_2, A_3 are the weight factor of different decay channels and τ_1, τ_2 and τ_3 are the corresponding decay lifetime constants. Based on these decay parameters, the average lifetime can be determined as

$$\tau_{ave} = \frac{A_1\tau_1^{\,2} + A_2\tau_2^{\,2} + A_3\tau_3^{\,2}}{A_1\tau_1 + A_2\tau_2 + A_3\tau_3} \quad (2)$$